PRICE $2.00

CONDENSED

HEATH COMPANY • BENTON HARBOR, MICHIGAN

# HEATHKIT®
# ASSEMBLY MANUAL

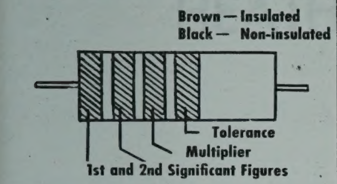
HEATHKIT® by DAYSTROM

# REGULATED POWER SUPPLY

MODEL PS-4

# STANDARD COLOR CODE — RESISTORS AND CAPACITORS

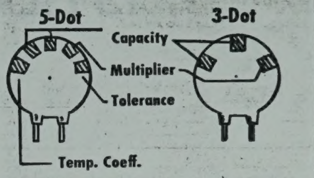
### AXIAL LEAD RESISTOR



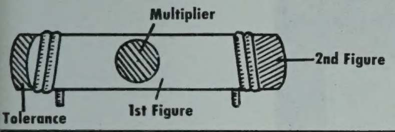
Wire wound resistors have 1st digit band double width

| INSULATED UNINSULATED Color | FIRST RING BODY COLOR First Figure | SECOND RING END COLOR Second Figure | THIRD RING DOT COLOR Multiplier |
|---|---|---|---|
| BLACK | 0 | 0 | None |
| BROWN | 1 | 1 | 0 |
| RED | 2 | 2 | 00 |
| ORANGE | 3 | 3 | ,000 |
| YELLOW | 4 | 4 | 0,000 |
| GREEN | 5 | 5 | 00,000 |
| BLUE | 6 | 6 | 000,000 |
| VIOLET | 7 | 7 | 0,000,000 |
| GRAY | 8 | 8 | 00,000,000 |
| WHITE | 9 | 9 | 000,000,000 |

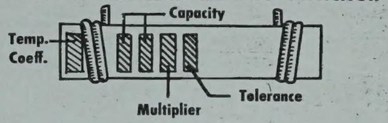
### DISC CERAMIC RMA CODE



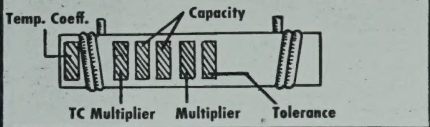
### RADIAL LEAD DOT RESISTOR



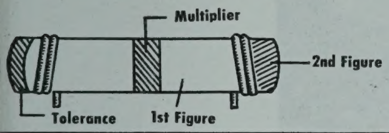
### 5-DOT RADIAL LEAD CERAMIC CAPACITOR



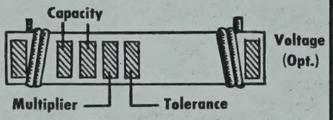
### EXTENDED RANGE TC CERAMIC HICAP



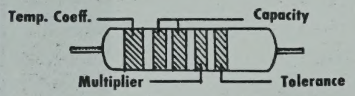
### RADIAL LEAD (BAND) RESISTOR



### BY-PASS COUPLING CERAMIC CAPACITOR



### AXIAL LEAD CERAMIC CAPACITOR

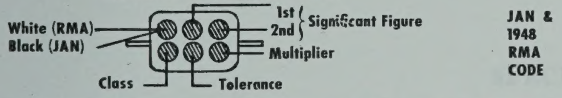


The standard color code provides all necessary information required to properly identify color coded resistors and capacitors. Refer to the color code for numerical values and the zeroes or multipliers assigned to the colors used. A fourth color band on resistors determines tolerance rating as follows: Gold = 5%, silver = 10%. Absence of the fourth band indicates a 20% tolerance rating.

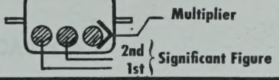
The physical size of carbon resistors is determined by their wattage rating. Carbon resistors most commonly used in Heathkits are ½ watt. Higher wattage rated resistors when specified are progressively larger in physical size. Small wire wound resistors ½ watt, 1 or 2 watt may be color coded but the first band will be double width.

## MOLDED MICA TYPE CAPACITORS

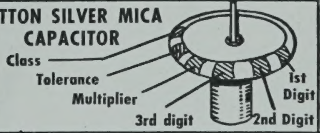
### CURRENT STANDARD CODE



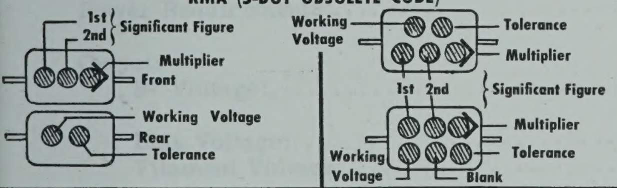
### RMA 3-DOT (OBSOLETE) RATED 500 W.V.D.C. ± 20% TOL.



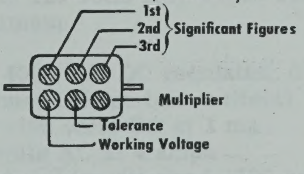
### BUTTON SILVER MICA CAPACITOR



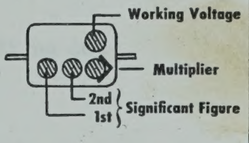
### RMA (5-DOT OBSOLETE CODE)



### RMA 6-DOT (OBSOLETE)

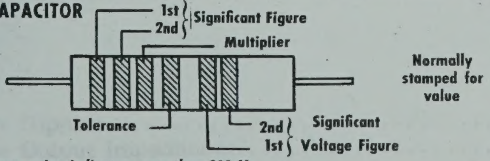


### RMA 4-DOT (OBSOLETE)



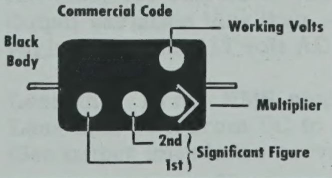
## MOLDED PAPER TYPE CAPACITORS

### TUBULAR CAPACITOR

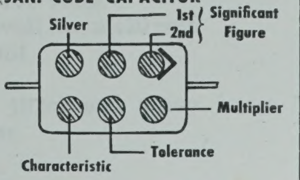


A 2 digit voltage rating indicates more than 900 V. Add 2 zeros to end of 2 digit number.

### MOLDED FLAT CAPACITOR



### JAN. CODE CAPACITOR



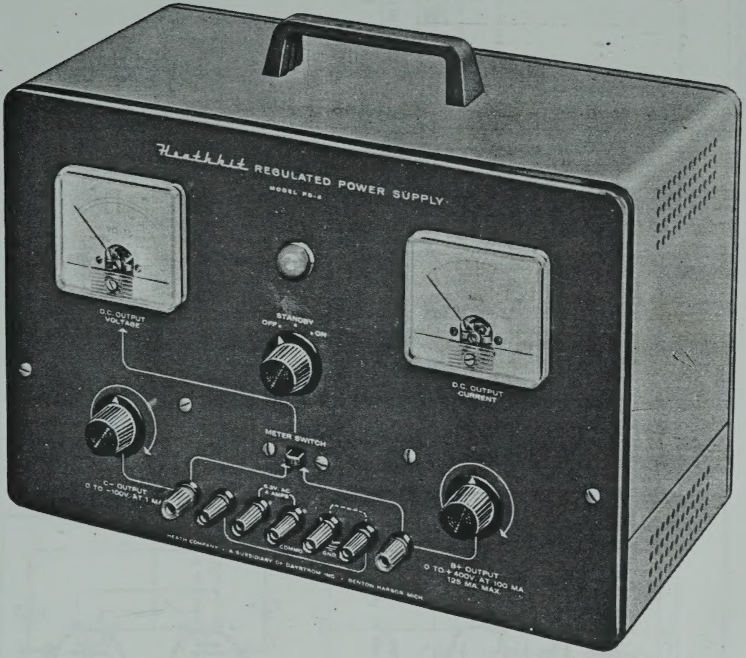
The tolerance rating of capacitors is determined by the color code. For example: red = 2%, green = 5%, etc. The voltage rating of capacitors is obtained by multiplying the color value by 100. For example: orange = 3 × 100 or 300 volts. Blue = 6 × 100 or 600 volts.

In the design of Heathkits, the temperature coefficient of ceramic or mica capacitors is not generally a critical factor and therefore Heathkit manuals avoid reference to temperature coefficient specifications.

Courtesy of Centralab

# ASSEMBLY AND OPERATION OF THE HEATHKIT REGULATED POWER SUPPLY

## MODEL PS-4


Heathkit REGULATED POWER SUPPLY
MODEL PS-4
D.C. OUTPUT VOLTAGE
STANDBY
OFF
ON
D.C. OUTPUT CURRENT
METER SWITCH
C- OUTPUT 0 TO -100V. AT 1 MA
6.3V AC 4 AMPS
COMMON
GND.
B+ OUTPUT 0 TO +400V. AT 100 MA 125 MA. MAX.
HEATH COMPANY • A SUBSIDIARY OF DAYSTROM INC • BENTON HARBOR MICH

## SPECIFICATIONS

| | |
|---|---|
| Power Requirements: | 105 to 125 volts AC, 50/60 cycle, 150 watts maximum |
| Output: | |
| B+ Voltage: | 0 to 400 volts DC regulated; 0 to 100 ma continuous (125 ma intermittent) |
| Bias Voltage: | 0 to -100 volts DC at 1 ma |
| Filament Voltage: | 6.3 volts AC at 4 amps<br>(Insulated to withstand 1500 volts DC) |
| B+ Regulation: | Output variation less than 1% from no load to full load, for outputs of 100 to 400 volts<br>Output variation less than ±0.5 volt for a ±10 volt variation in the 117 volt AC input |
| B+ Ripple: | Less than 10 mv RMS ripple, jitter and noise |
| B+ Output Impedance: | Less than 10 Ω from DC to 1 mc<br>(See output impedance curve.) |

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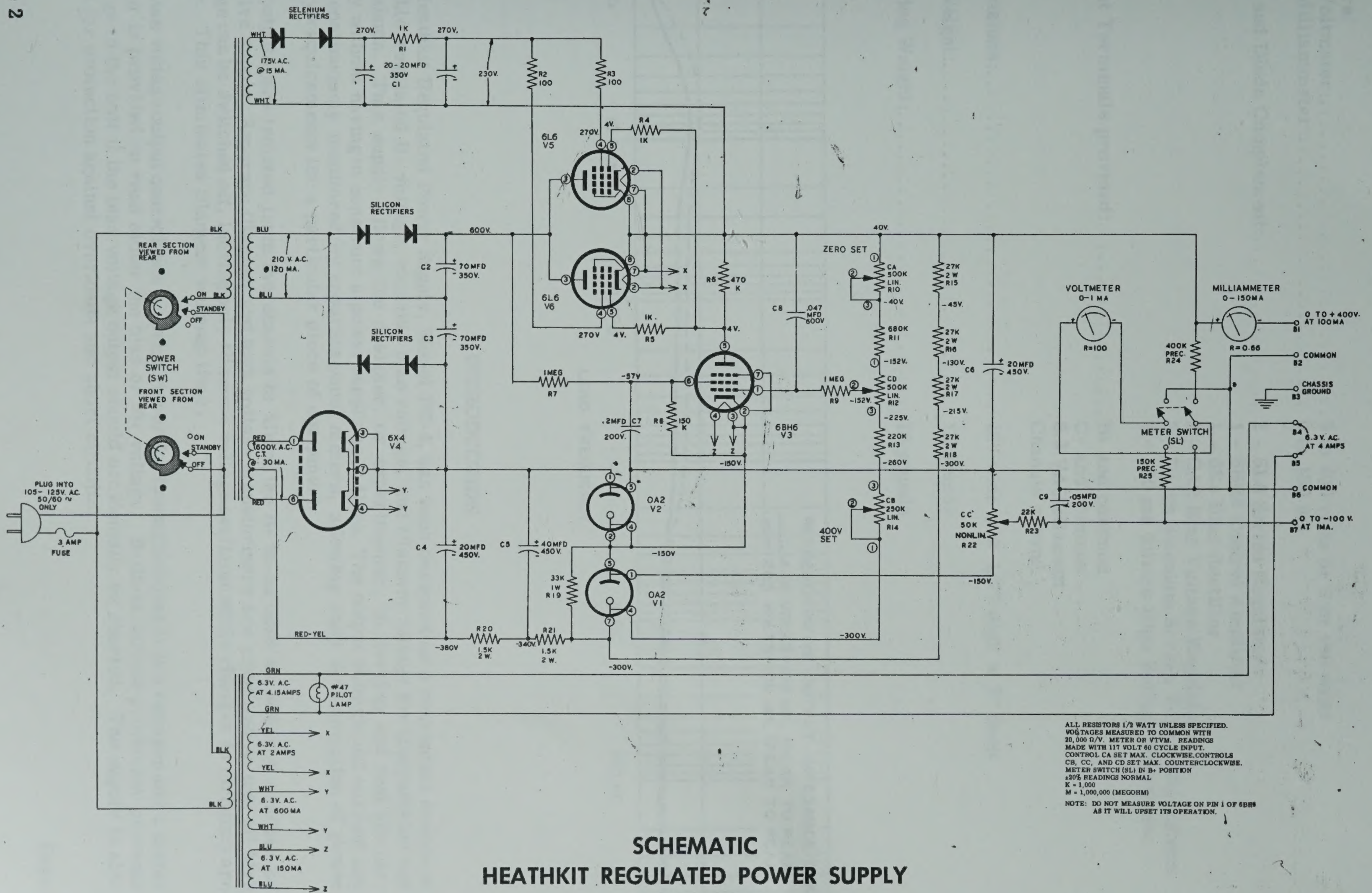
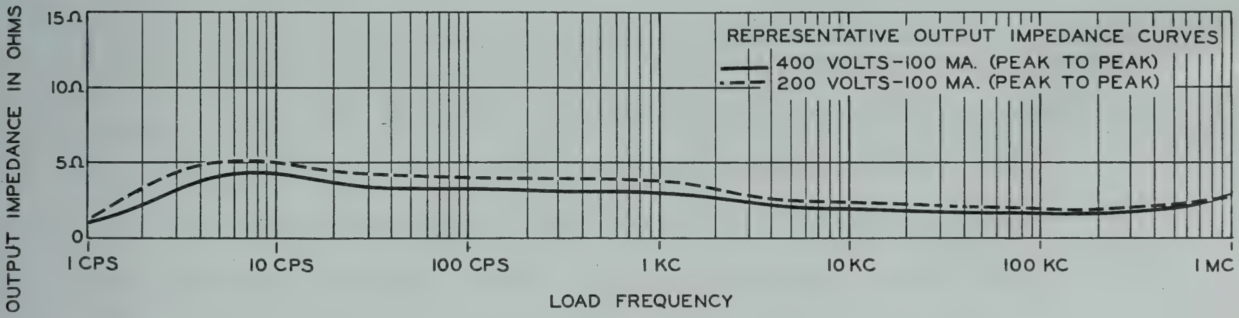


ALL RESISTORS 1/2 WATT UNLESS SPECIFIED.
VOLTAGES MEASURED TO COMMON WITH
20,000 Ω/V. METER OR VTVM. READINGS
MADE WITH 117 VOLT 60 CYCLE INPUT.
CONTROL CA SET MAX. CLOCKWISE. CONTROLS
CB, CC, AND CD SET MAX. COUNTERCLOCKWISE.
METER SWITCH (SL) IN B+ POSITION
±20% READINGS NORMAL
K = 1,000
M = 1,000,000 (MEGOHM)

NOTE: DO NOT MEASURE VOLTAGE ON PIN 1 OF 6BH6
AS IT WILL UPSET ITS OPERATION.

# SCHEMATIC
# HEATHKIT REGULATED POWER SUPPLY
# MODEL PS-4

| | |
|---|---|
| Meters: | |
| Voltmeter: | 0 to 400 volts or 0 to 150 volts |
| Milliammeter: | 0 to 150 ma |
| Tube and Diode Complement: | 2 - 6L6 Series Regulators<br>1 - 6BH6 Control Amplifier<br>1 - 6X4 Bias Rectifier<br>2 - OA2 Bias Voltage Regulators<br>2 - 50 ma Selenium Screen Voltage Rectifiers<br>4 - 150 ma Silicon High Voltage Rectifiers |
| Output Terminals provided: | B+ and common<br>C- and common<br>6.3 VAC filament<br>Chassis ground |
| Dimensions: | 13" wide x 8 1/2" high x 7" deep |
| Net Weight: | 12 pounds |
| Shipping Weight: | 16 pounds |



## INTRODUCTION

The Heathkit Regulated Power Supply, Model PS-4, has been designed as a convenient source of variable regulated B+ voltage, variable bias voltage, and filament voltage for laboratories and workshops. This supply allows the designer, or experimenter, to develop and test his circuitry without having to construct a power supply each time. The output voltage and current are both continuously monitored by separate panel meters, allowing easy determination of power supply requirements for a particular piece of equipment.

The outputs are isolated from the chassis to allow the B+ to be used as either a positive or negative supply. Separate filament and high voltage transformers are employed so that all high voltage can be switched off, leaving only filament voltage available while changes in circuitry are made. This eliminates filament warmup time.

The bias voltage output control has a special taper for fine adjustment at low voltages and a meter switch is provided to read either the bias or B+ voltage. Built-in circuit protection prevents damage to the unit if the bias voltage output should accidentally be shorted. The supply is also fused for protection against overloads and short circuits.

## OPERATION AND ADJUSTMENT

( ) Set the power switch (SW) to the OFF position.

( ) Set the bias C- OUTPUT control (CC) and the high voltage B+ OUTPUT control (CD) maximum counterclockwise.

( ) Set the ZERO SET control (CA) maximum clockwise (from top of chassis).

( ) Set the 400 VOLT SET control (CB) maximum counterclockwise (from top of chassis).

( ) Set the meter slide switch (SL) to the B+ OUTPUT position.

NOTE: Do not connect any load to the Supply at this time.

( ) Connect the line cord to a 105-125 volt 50-60 cycle AC outlet.

CAUTION: This instrument will not operate, and may be seriously damaged, if connected to a DC or 25 cycle AC power source or to an AC line of more than 125 volts.

( ) Turn the power switch to STANDBY and allow a few minutes for the tube heaters to come up to operating temperature. Check to be sure that the heaters of the 6X4, 6BH6, and 6L6's are lit.

( ) Turn the power switch to ON. If the unit is functioning properly, the output current will be zero (0) and the voltage will be between zero (0) and 100 volts.

( ) Adjust the ZERO SET control (CA) counterclockwise until the output voltage reads zero (0).

( ) Now set the high voltage B+ OUTPUT control (CD) maximum clockwise.

( ) Adjust the 400 VOLT SET control (CB) clockwise until the output voltage reads 400 volts.

( ) Now set the high voltage B+ OUTPUT control (CD) back to its maximum counterclockwise position.

( ) Because the ZERO SET and 400 VOLT SET controls interact with each other, it will be necessary to repeat the above four steps about 3 or 4 times.

( ) This completes the adjustment of the unit. Unplug the instrument and insert it into the cabinet. Secure in the back with two 6-32 x 3/8" binder head machine screws.

( ) For normal operation, connect a jumper lead (piece of bare wire) from the chassis ground terminal (B3) to the adjacent common terminal (B2).

### Regulated B+ Output:

Connect the load between the B+ OUTPUT and the COMMON terminals. Rotate the B+OUTPUT control clockwise to the desired output voltage. Read the output current and voltage (400 volt scale) on the two meters. Use care not to exceed the output ratings. Note the warning red line at 100 ma on the milliammeter.

### Bias C- Output:

Connect the bias or other light load between the C- OUTPUT and COMMON terminals. Set the meter slide switch in the C- OUTPUT position. Rotate the C- OUTPUT control clockwise to the desired output voltage and read the output voltage (150 volt scale) on the voltmeter.

NOTE: The bias output current is not metered.

Filament Output:

Connect the filament load to the two filament voltage output terminals. This is a fixed 6.3 volts, with a maximum output of 4 amperes. Use care not to exceed this output rating.

NOTE: This output is insulated to withstand up to 1500 volts DC between it and common.

## OUTPUT METER ACCURACY

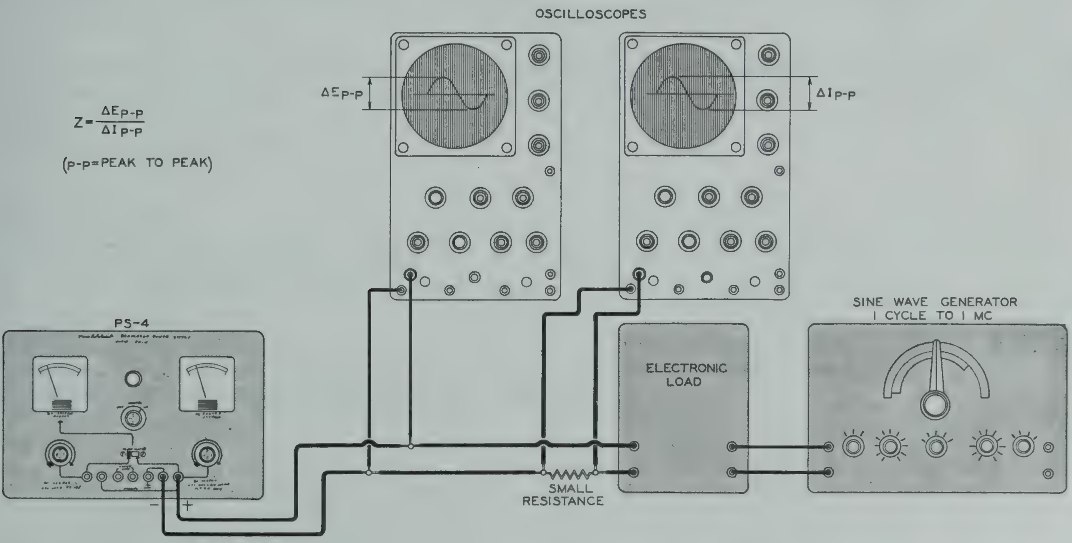
| | |
|---|---|
| Output Current (full scale) | ±2% |
| Output Voltage (full scale) | ±3% |

NOTE: Both output meters have a full scale accuracy of ±2%, but because of the ±1% dropping resistor in series with the voltmeter, its total accuracy is ±3%. However, it is not likely that the meter and resistor tolerance would both be additive maximums. Therefore we would assume its total accuracy to be well within the specified ±3%.

## EQUIPMENT LIST

Test equipment used in making the specification measurements for the Heathkit Regulated Power Supply Model PS-4:

| | |
|---|---|
| Generators: | Heathkit AG-9 Audio Generator<br>Heathkit AG-10 Audio Generator |
| Meters: | Hewlett-Packard Model 400D Audio Voltmeter<br>Waveforms Model 520-A Audio Voltmeter<br>Triplett Model 660 AC Wattmeter<br>Heathkit V-7A Vacuum Tube Voltmeter<br>Heathkit MM-1 Multimeter |
| Oscilloscope: | Heathkit OP-1 Professional Oscilloscope<br>Tektronix 515 Oscilloscope |
| Line Voltage Control: | General Radio Company Type W5MT Variac |
| Electronic Load: | Special design Static and Dynamic Load |



DETERMINATION OF OUTPUT IMPEDANCE USING
ELECTRONIC STATIC AND DYNAMIC LOAD

## SUGGESTED READING LIST

For those who are interested, there are many articles on Regulated Power Supplies published in the various electronic magazines. Also there are several fine books on the subject. A recommended few are listed below:

| | |
|---|---|
| Langford-Smith | RADIOTRON DESIGNER'S HANDBOOK, 4th edition, (Radio Corp. of America), Chapter 33, Pages 614-617. |
| Terman | ELECTRONIC AND RADIO ENGINEERING, 4th edition, (McGraw-Hill), Section 20-8, Pages 725-727. |
| Radiation Lab Series | ELECTRONIC INSTRUMENTS, Vol. 21, Chapter 16, Pages 523-570. |
| A. R. R. L. | THE RADIO AMATEUR'S HANDBOOK, 35th edition, 1958, Chapter 7, Pages 231-237. |

## IN CASE OF DIFFICULTY

1. Recheck the wiring to make sure no errors or wrong connections exist. Using colored pencils, trace each lead on the pictorial as it is followed in the unit. Having a friend check the wiring will often reveal a mistake consistently overlooked.

2. Check all parts to be sure they are the proper value. Recheck color coding on all resistors and transformer leads. Check polarity on all electrolytic capacitors.

3. Examine all soldered connections for evidence of "cold" or "rosin" joints. Reheat any connections that appear suspicious. A good connection should appear smooth and shiny.

4. Examine all connections carefully for excessive solder or wire clippings thay may be causing a short circuit between adjacent terminals or to the chassis.

5. Check to make sure that none of the components were damaged, mechanically or from excessive heat during soldering, when they were installed.

6. Compare voltages in the unit with those indicated on the Schematic wiring diagram. Wide discrepancies indicate improper wiring, bad connections, or a defective component.

### Possible Causes of Trouble

1. Faulty tube.
2. Open, shorted, or leaky capacitor.
3. Defective, or off value resistor.
4. Faulty silicon or selenium rectifier.
5. Faulty transformer.

If a defective or damaged component is discovered, or if trouble persists, refer to the REPLACEMENT or SERVICE section of this manual.

If, after applying the information contained in this manual and your best efforts, you are still unable to obtain proper performance, it is suggested that you take advantage of the technical facilities which the Heath Company makes available to its customers.

The Technical Consultation Department is maintained for your benefit. This service is available to you at no charge. Its primary purpose is to provide assistance for those who encounter difficulty in the construction, operation or maintenance of HEATHKIT equipment. It is not intended, and is not equipped to function as a general source of technical information involving kit modifications nor anything other than the normal and specified performance of HEATHKIT equipment.

Although the Technical Consultants are familiar with all details of this kit, the effectiveness of their advice will depend entirely upon the amount and the accuracy of the information furnished by you. In a sense, YOU MUST QUALIFY for GOOD technical advice by helping the consultants to help you. Please use this outline:

1. Before writing, fully investigate each of the hints and suggestions listed in this manual under "IN CASE OF DIFFICULTY." Possibly it will not be necessary to write.
2. When writing, clearly describe the nature of the trouble and mention all associated equipment. Specifically report operating procedures, switch positions, connections to other units and anything else that might help to isolate the cause of trouble.
3. Report fully on the results obtained when testing the unit initially and when following the suggestions under "IN CASE OF DIFFICULTY." Be as specific as possible and include voltage readings if test equipment is available.
4. Identify the kit model number and date of purchase, if available.
5. Print or type your name and address, preferably in two places on the letter.

With the preceding information, the consultant will know exactly what kit you have, what you would like it to do for you and the difficulty you wish to correct. The date of purchase tells him whether or not engineering changes have been made since it was shipped to you. He will know what you have done in an effort to locate the cause of trouble and, thereby, avoid repetitious suggestions. In short, he will devote full time to the problem at hand, and through his familiarity with the kit, plus your accurate report, he will be able to give you a complete and helpful answer. If replacement parts are required, they will be shipped to you, subject to the terms of the Warranty.

The Factory Service facilities are also available to you, in case you are not familiar enough with electronics to provide our consultants with sufficient information on which to base a diagnosis of your difficulty, or in the event that you prefer to have the difficulty corrected in this manner. You may return the completed instrument to the Heath Company for inspection and necessary repairs and adjustments. You will be charged a minimal service fee, plus the price of any additional parts or material required. However, if the completed kit is returned within the Warranty period, parts charges will be governed by the terms of the Warranty. State the date of purchase, if possible.

Local Service by Authorized HEATHKIT Service Centers is also available in some areas and often will be your fastest, most efficient method of obtaining service for your HEATHKIT equipment. Although you may find charges for local service somewhat higher than for factory service, the amount of increase is usually offset by the transportation charge you would pay if you elected to return your kit to the Heath Company.

HEATHKIT Service Centers will honor the regular 90 day HEATHKIT Parts Warranty on all kits, whether purchased through a dealer or directly from Heath Company; however, it will be necessary that you verify the purchase date of your kit.

Under the conditions specified in the Warranty, replacement parts are supplied without charge; however, if the Service Center assists you in locating a defective part (or parts) in your kit, or installs a replacement part for you, you may be charged for this service.

HEATHKIT equipment purchased locally and returned to Heath Company for service must be accompanied by your copy of the dated sales receipt from your authorized HEATHKIT dealer in order to be eligible for parts replacement under the terms of the Warranty.

THIS SERVICE POLICY APPLIES ONLY TO COMPLETED EQUIPMENT CONSTRUCTED IN ACCORDANCE WITH THE INSTRUCTIONS AS STATED IN THE MANUAL. Equipment that has been modified in design will not be accepted for repair. If there is evidence of acid core solder or paste fluxes, the equipment will be returned NOT repaired.

For information regarding modification of HEATHKIT equipment for special applications, it is suggested that you refer to any one or more of the many publications that are available on all phases of electronics. They can be obtained at or through your local library, as well as at most electronic equipment stores. Although the Heath Company sincerely welcomes all comments and suggestions, it would be impossible to design, test, evaluate and assume responsibility for proposed circuit changes for special purposes. Therefore, such modifications must be made at the discretion of the kit builder, using information available from sources other than the Heath Company.

## REPLACEMENTS

Material supplied with HEATHKIT products has been carefully selected to meet design requirements and ordinarily will fulfill its function without difficulty. Occasionally improper instrument operation can be traced to a faulty component. Should inspection reveal the necessity for replacement, write to the Heath Company and supply all of the following information.

A. Thoroughly identify the part in question by using the part number and description found in the manual Parts List.

B. Identify the type and model number of kit in which it is used.

C. Mention date of purchase.

D. Describe the nature of defect or reason for requesting replacement.

The Heath Company will promptly supply the necessary replacement. PLEASE DO NOT RETURN THE ORIGINAL COMPONENT UNTIL SPECIFICALLY REQUESTED TO DO SO. Do not dismantle the component in question as this will void the guarantee. This replacement policy does not cover the free replacement of parts that may have been broken or damaged through carelessness on the part of the kit builder.

## SHIPPING INSTRUCTIONS

In the event that your instrument must be returned for service, these instructions should be carefully followed.

ATTACH A TAG TO THE EQUIPMENT BEARING YOUR NAME, COMPLETE ADDRESS, DATE OF PURCHASE, AND A BRIEF DESCRIPTION OF THE DIFFICULTY ENCOUNTERED. Wrap the equipment in heavy paper, exercising care to prevent damage. Place the wrapped equipment in a stout carton of such size that at least three inches of shredded paper, excelsior, or other resilient packing material can be placed between all sides of the wrapped equipment and the carton. Close and seal the carton with gummed paper tape, or alternately, tie securely with stout cord. Clearly print the address on the carton as follows:

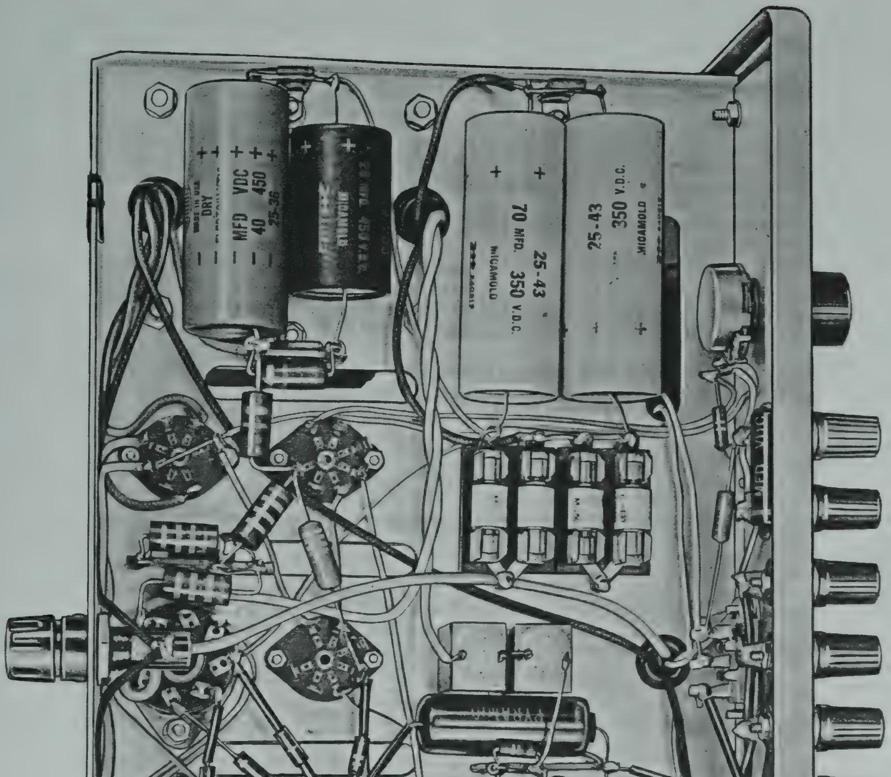
To: HEATH COMPANY
Benton Harbor, Michigan

Include your name and return address on the outside of the carton. Preferably affix one or more "Fragile" or "Handle With Care" labels to the carton, or otherwise so mark with a crayon of bright color. Ship by parcel post or prepaid express; note that a carrier cannot be held responsible for damage in transit if, in HIS OPINION, the article is inadequately packed for shipment.

# PARTS LIST

| PART No. | PARTS Per Kit | DESCRIPTION |
|---|---|---|
| **Resistors** | | |
| 1-3 | 2 | 100 Ω |
| 1-9 | 3 | 1 KΩ |
| 1-22 | 1 | 22 KΩ |
| 1-27 | 1 | 150 KΩ |
| 1-29 | 1 | 220 KΩ |
| 1-33 | 1 | 470 KΩ |
| 1-34 | 1 | 680 KΩ |
| 1-35 | 2 | 1 megohm |
| 1-27A | 1 | 33 KΩ 1 watt |
| 1-14B | 2 | 1.5 KΩ 2 watt |
| 1-6B | 4 | 27 KΩ 2 watt |
| 2-86 | 1 | 150 KΩ precision |
| 2-138 | 1 | 400 KΩ precision |
| **Capacitors** | | |
| 23-45 | 1 | .047 μfd 600 V |
| 23-59 | 1 | .05 μfd 200 V |
| 23-58 | 1 | 0.2 μfd 200 V |
| 25-30 | 1 | 20-20 μfd 350 V |
| 25-33 | 2 | 20 μfd 450 V |
| 25-36 | 1 | 40 μfd 450 V |
| 25-43 | 2 | 70 μfd 350 V |
| **Controls-Switches** | | |
| 10-26 | 1 | 500 KΩ control |
| 10-59 | 1 | 250 KΩ control (Tab mount) |
| 10-60 | 1 | 500 KΩ control (Tab mount) |
| 10-89 | 1 | 50 KΩ control |
| 60-2 | 1 | DPDT slide switch |
| 63-189 | 1 | 3-position rotary switch |
| **Transformers-Rectifiers** | | |
| 54-76 | 1 | Filament transformer |
| 54-77 | 1 | Power transformer |
| 57-13 | 2 | 50 ma selenium rectifier |
| 57-21 | 4 | 150 ma silicon rectifier |
| **Sheet Metal Parts** | | |
| 90-96 | 1 | Cabinet |
| 200-M196 | 1 | Chassis |
| 203-166F241 | 1 | Front panel |
| **Meters-Tubes-Lamp** | | |
| 407-56 | 1 | Voltmeter |
| 407-57 | 1 | Milliammeter |
| 411-8 | 2 | 6L6 tube |
| 411-59 | 2 | OA2 tube |
| 411-64 | 1 | 6X4 tube |
| 411-95 | 1 | 6BH6 tube |
| 412-1 | 1 | #47 lamp |

| PART No. | PARTS Per Kit | DESCRIPTION |
|---|---|---|
| **Holders-Sockets-Terminal Strips** | | |
| 422-2 | 2 | Rectifier holder |
| 423-1 | 1 | Fuse holder |
| 431-1 | 2 | 1-lug terminal strip |
| 431-2 | 1 | 2-lug terminal strip |
| 431-3 | 1 | 3-lug terminal strip |
| 431-5 | 1 | 4-lug terminal strip |
| 431-27 | 1 | 3-lug terminal strip |
| 434-15 | 4 | 7-pin tube socket |
| 434-58 | 2 | Octal tube socket |
| **Hardware** | | |
| 100-M16B | 5 | Binding post cap (Black) |
| 100-M16R | 2 | Binding post cap (Red) |
| 250-9 | 4 | 6-32 x 3/8" RHMS |
| 250-18 | 8 | 8-32 x 3/8" RHMS |
| 250-49 | 8 | 3-48 x 1/4" BHMS |
| 250-83 | 2 | #10 x 1/2" screw |
| 250-89 | 17 | 6-32 x 3/8" BHMS |
| 252-1 | 8 | 3-48 nut |
| 252-3 | 26 | 6-32 nut |
| 252-4 | 8 | 8-32 nut |
| 252-7 | 3 | Control nut |
| 252-22 | 2 | 6-32 speednut |
| 253-9 | 8 | #8 flat washer |
| 253-10 | 3 | Control flat washer |
| 254-1 | 18 | #6 lockwasher |
| 254-2 | 8 | #8 lockwasher |
| 254-4 | 3 | Control lockwasher |
| 259-1 | 8 | #6 solder lug |
| 261-4 | 4 | Cabinet feet |
| 340-2 | 1 | Length bare wire |
| 344-1 | 1 | Length hookup wire |
| 346-1 | 1 | Length sleeving |
| 421-2 | 1 | 3 amp fuse |
| 427-2 | 7 | Binding post base |
| 434-22 | 1 | Pilot lamp assembly |
| **Miscellaneous** | | |
| 73-3 | 1 | 1/2" grommet |
| 75-17 | 14 | Insulator bushing |
| 75-24 | 1 | Line cord bushing |
| 89-1 | 1 | Line cord |
| 211-4 | 1 | Cabinet handle |
| 462-52 | 3 | Knob (black) |
| 595-231 | 1 | Instruction manual |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# HELPFUL KIT BUILDING INFORMATION

Before attempting actual kit construction read the construction manual through thoroughly to familiarize yourself with the general procedure. Note the relative location of pictorials and pictorial inserts in respect to the progress of the assembly procedure outlined.

This information is offered primarily for the convenience of novice kit builders and will be of definite assistance to those lacking thorough knowledge of good construction practices. Even the advanced electronics enthusiast may benefit by a brief review of this material before proceeding with kit construction. In the majority of cases, failure to observe basic instruction fundamentals is responsible for inability to obtain desired level of performance.

## RECOMMENDED TOOLS

The successful construction of Heathkits does not require the use of specialized equipment and only basic tools are required. A good quality electric soldering iron is essential. The preferred size would be a 100 watt iron with a small tip. The use of long nose pliers and diagonal or side cutting pliers is recommended. A small screw driver will prove adequate and several additional assorted screw drivers will be helpful. Be sure to obtain a good supply of rosin core type radio solder. Never use separate fluxes, paste or acid solder in electronic work.

## ASSEMBLY

In the actual mechanical assembly of components to the chassis and panel, it is important that the procedure shown in the manual be carefully followed. Make sure that tube sockets are properly mounted in respect to keyway or pin numbering location. The same applies to transformer mountings so that the correct transformer color coded wires will be available at the proper chassis opening.

Make it a standard practice to use lock washers under all 6-32 and 8-32 nuts. The only exception being in the use of solder lugs—the necessary locking feature is already incorporated in the design of the solder lugs. A control lock washer should always be used between the control and the chassis to prevent undesirable rotation in the panel. To improve instrument appearance and to prevent possible panel marring use a control flat nickel washer under each control nut.

When installing binding posts that require the use of fiber insulating washers, it is good practice to slip the shoulder washer over the binding post mounting stud before installing the mounting stud in the panel hole provided. Next, install a flat fiber washer and a solder lug under the mounting nut. Be sure that the shoulder washer is properly centered in the panel to prevent possible shorting of the binding post.

## WIRING

When following wiring procedure make the leads as short and direct as possible. In filament wiring requiring the use of a twisted pair of wires allow sufficient slack in the wiring that will permit the twisted pair to be pushed against the chassis as closely as possible thereby affording relative isolation from adjacent parts and wiring.

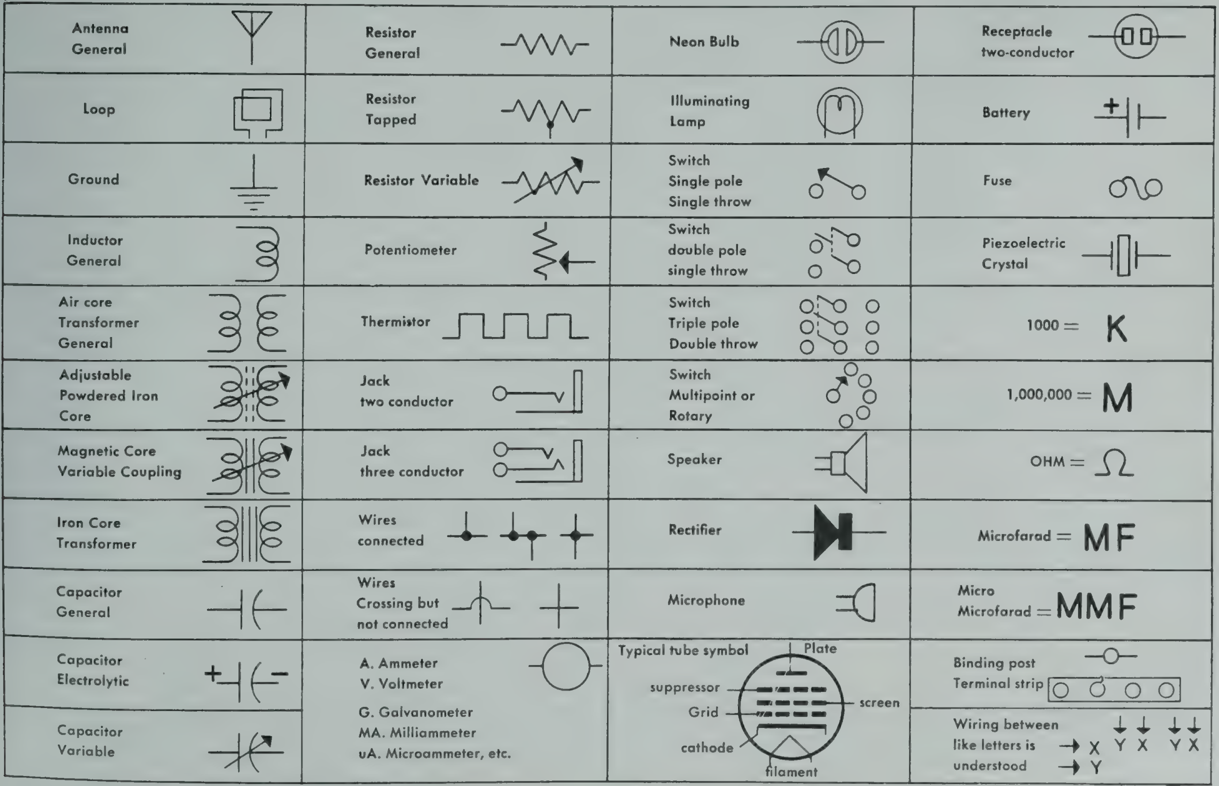
When removing insulation from the end of hookup wire, it is seldom necessary to expose more than a quarter inch of the wire. Excessive insulation removal may cause a short circuit condition in respect to nearby wiring or terminals. In some instances, transformer leads of solid copper will have a brown baked enamel coating. After the transformer leads have been trimmed to a suitable length, it is necessary to scrape the enamel coating in order to expose the bright copper wire before making a terminal or soldered connection.

In mounting parts such as resistors or condensers, trim off all excess lead lengths so that the parts may be installed in a direct point-to-point manner. When necessary use spaghetti or insulated sleeving over exposed wires that might short to nearby wiring.

It is urgently recommended that the wiring dress and parts layout as shown in the construction manual be faithfully followed. In every instance, the desirability of this arrangement was carefully determined through the construction of a series of laboratory models.

## SOLDERING

Much of the performance of the kit instrument, particularly in respect to accuracy and stability, depends upon the degree of workmanship used in making soldered connections. Proper soldered connections are not at all difficult to make but it would be advisable to observe a few precautions. First of all before a connection is to be soldered, the connection itself should be clean and mechanically strong. Do not depend on solder alone to hold a connection together. The tip of the soldering iron should be bright, clean and free of excess solder. Use enough heat to thoroughly flow the solder smoothly into the joint. Avoid excessive use of solder and do not allow a flux flooding condition to occur which could conceivably cause a leakage path between adjacent terminals on switch assemblies and tube sockets. This is particularly important in instruments such as the VTVM, oscilloscope and generator kits. Excessive heat will also burn or damage the insulating material used in the manufacture of switch assemblies. Be sure to use only good quality rosin core radio type solder.



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